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Department of Electrical, Information and Media Engineering

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Theoretical Nano-Photonics

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Subject: Official report of the TaCoNa-Photonics workshop, October 26-28 2011, Bad Honnef, Germany

Dear Sir / Madam,

please find enclosed an official report of the International Workshop on Theoretical and Computational Nano-Photonics (TaCoNa-Photonics 2011, October 26-28 2011, Bad Honnef, Germany).

We greatly appreciate the support by ESF and confirm hereby that without it successful running of the TaCoNa-Photonics 2011 with all relevant activities would be impossible.

Yours sincerely,

Dr. Dmitry N. Chigrin

## 1. Title of the meeting

The International Workshop on Theoretical and Communication Nano-Photonics  
(TaCoNa-Photonics 2011)

## 2. Date of meeting

October 26-28 2011

## 3. Location of the meeting

Physikzentrum, Bad Honnef, Germany

## 4. Objective of meeting

The past years have witnessed dramatic progress and interest in the micro- and nano-fabrication techniques of complex photonic systems. These structures are characterized by controlled feature sizes of the order of or even below the wavelength of light. As a consequence, multiple scattering and near field effects have a profound influence on the propagation of light and light-matter interaction in these systems. In turn, this leads to novel regimes for basic research as well as to novel applications in many disciplines, including advanced optical communications systems, novel optical and heat filters. Owing to the complex nature of wave interference and light-matter interaction processes, experimental studies of such nano-phonic systems heavily rely on theoretical guidance both for the design of experiment as well as for the interpretation of the measurements. In almost all cases, a quantitative theoretical description has to be based on advanced computational techniques. *The aim of the workshop is gathering leading researchers in computational and theoretical photonics of complex media in order to assess the current status of this rapidly developing interdisciplinary field and to discuss future developments.* The fourth International Workshop on Theoretical and Computational Nano-Photonics (TaCoNa-Photonics 2011) took place in the "Physikzentrum Bad Honnef", Bad Honnef, Germany on October 26-28 2011. 68 participants from 20 countries have contributed to the workshop. Topics of the workshop were covered in 3 plenary, 14 invited, 18 contributed oral and 23 poster presentations.

## 5. Workshop webpage

<http://www.tacona-photonics.org/?q=tacona-2011.html>

## 6. Sponsoring organizations

- Karlsruhe School of Optics and Photonics (KSOP) – *commercial event service*
- European Science Foundation
- CST-Computer Simulation Technology AG (Germany)
- Wiley-VCH (Germany)

## 7. Name and full contact details (address, telephone, e-mail) of the organizer and names of the organizing committee members:

**Organizing Committee Chairman:**

***Dmitry N. Chigrin***

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### **Organizing and Technical Committee:**

1. Mario Agio - ETH Zurich, Switzerland
2. Kurt Busch - University of Karlsruhe, Germany
3. Dmitry N. Chigrin - University of Wuppertal, Germany - **Chair**
4. Jonathan P. Dowling - Louisiana State University, USA
5. Stefan Enoch - Fresnel Institute, France
6. Jens Foerstner - University of Padernborn, Germany
7. Ortwin Hess - University of Surrey, UK
8. Maria Kafesaki - IESL-FORTH, Greece
9. Andrei V. Lavrinenko - Technical University of Denmark, Denmark
10. Torsten Meier - University of Padernborn, Germany
11. Andrey A. Sukhorukov - Australian National University, Australia

### **8. List of plenary speakers:**

1. Martin Aeschlimann (University of Kaiserslautern, Germany)
2. Vahid Sandoghdar (MPI for the Science of Light, Germany)
3. Yurii A. Vlasov (IBM TJ Watson Research Center, USA)

### **9. List of invited speakers:**

1. Javier García de Abajo (IO-CSIC, Spain)
2. Rémi Carminati (ESPCI ParisTech, CNRS, France)
3. Che Ting Chan (HK University of Science and Technology, Hong Kong)
4. Dmitry Chigrin (University of Wuppertal, Germany)
5. Cristiano Ciuti (Université Paris Diderot-Paris 7, France)
6. Stavroula Foteinopoulou (University of Exeter, UK)
7. Stephen Hughes (Queen's University, Canada)
8. Serguei Patchkovskii (National Research Council, Canada)
9. Helmut Ritsch (Universität Innsbruck, Austria)
10. Carsten Rockstuhl (Friedrich-Schiller-Universität Jena, Germany)
11. Juan Jose Saenz (Universidad Autonoma de Madrid, Spain)
12. Salvatore Savasta (Università di Messina, Italy)
13. Barry Sanders (University of Calgary, Canada)
14. Victor Veselago (Institute of General Physics, Russia)

## **10. Program**

### **Wednesday - October 26, 2011**

8:00-8:45      *Breakfast*

8:45-9:00      Welcome Address

#### **Session 1 – Chair Person: *Dmitry Chigrin***

9:00-10:00      CMOS integrated nanophotonics for future computing systems  
*Yurii Vlasov*

**Plenary Talk 1**

10:00-10:45 Dirac cone and double zero materials p. 21

**Invited Talk 1** *C. T. Chan, Xueqin Huang, Yun Lai, Zhi Hong Hang, Huihuo Zheng*

10:45-11:25 *Coffee Break*

**Session 2 – Chair Person: Yurii Vlasov**

11:25-11:45 Surface Plasmon Polariton Modulator with Periodic Patterning of Indium Tin Oxide Layers p. 59

*Viktoria Babicheva, Andrei Lavrinenko*

11:45-11:05 Bending light on a chip with Airy plasmons • *Dragomir Neshev, Alexander Minovich, Wei Liu, Angela Klein, Norik Janunts, Ilya Shadrivov, Andrey Miroshnichenko, Thomas Pertsch, Yuri Kivshar* p. 77

12:05-12:25 Transport properties of MOPhC/metal one-way waveguide p. 65

*Sergey Eyderman, Vladimir Kuzmiak*

12:30-14:00 *Lunch*

**Session 3 – Chair Person: Che Ting Chan**

14:00-14:45 Master equations for semiconductor cavity-QED p. 32

**Invited Talk 2** *Stephen Hughes, C. Roy*

14:45-15:30 Quantum optics in superconducting circuits p. 45

*Barry Sanders*

**Invited Talk 3**

15:30-15:50 Scattering Induced Quantum Interference of Multiple Quantum Optical States p. 80

*Johan R. Ott, N. Asger Mortensen, Peter Lodahl*

15:50-16:10 Effective mode volumes for leaky optical cavities • *Philip Trøst Kristensen, Cole Van Vlack, Stephen Hughes* p. 98

16:10-16:50 *Coffee Break*

**Session 4 – Chair Person: Stephen Hughes**

16:50-17:35 Quantum fluids of light in nonlinear polaritonic systems p. 25

*Cristiano Ciuti*

**Invited Talk 4**

17:35-18:20 Towards understanding dynamics of atoms and molecules in intense laser fields p. 37

**Invited Talk 5** *Serguei Patchkovskii*

18:20-18:40 Coherent random lasing in diffusive resonant media • *Ravitej Uppu, Anjanikumar Tiwari, Sushil Mujumdar* p. 101

18:40-19:00 Ultrafast nonlinear spectroscopy with spatially confined fields p. 92

*Felix Schlosser, Mario Schoth, Sven Burger, Frank Schmidt, Andreas Knorr, Shaul Mukamel, Marten Richter*

19:00-20:30 *Dinner*

**20:30-22:00 Poster Session**

**Thursday - October 27, 2011**

8:00-9:00 *Breakfast*

**Session 5 – Chair Person: Barry Sanders**

9:00-10:00 Optical antennas for modifying the radiation of single quantum emitters p. 14

**Plenary Talk 2** *Vahid Sandoghdar*

10:00-10:45 Near-field correlations and fluctuations in multiple scattering of light p. 19

**Invited Talk 6** *Remi Carminati*

10:45-11:25 *Coffee Break*

**Session 6 – Chair Person: Vahid Sandoghdar**

11:25-11:45 Analytical Description of Fano Resonances in Plasmonic Nanostructures p. 71

*Benjamin Gallinet, Olivier J. F. Martin*

11:45-11:05 On the Phase of the Electric Field in Optical Antennas p. 86

*Brice Rolly, Brian Stout, Sebastien Bidault, Nicolas Bonod*

12:05-12:25 Au/InAs Surface Plasmon Polariton Amplifier and SPASER p. 68

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12:30-14:00	Lunch	
<b>Session 7 – Chair Person: Serguei Patchkovskii</b>		
14:00-14:45	Quantum Coherence in Nano- and Micro-Photonics	p. 49
<b>Invited Talk 7</b>	<i>Salvatore Savasta</i>	
14:45-15:30	Quantum friction and radiative transfer	NA
<b>Invited Talk 8</b>	<i>Alejandro Manjavacas, Javier Garcia de Abajo</i>	
15:30-15:50	Enhancement of extraordinary transmission in subwavelength apertures by excitation of particle localized plasmons • <i>Francisco Javier Valdivia-Valero, Manuel Nieto-Vesperinas</i>	p. 104
15:50-16:10	Peculiarities of elementary transformation processes for 2D metal-dielectric structures <i>Boris Sturman, Evgeny Podivilov, Maxim Gorkunov</i>	p. 95
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16:10-16:50	Coffee Break	
<b>Session 8 – Chair Person: Cristiano Ciuti</b>		
16:50-17:35	About linear momentum of light in metamaterials and "Minkowsky-Abragam controversy" resolution	p. 54
<b>Invited Talk 9</b>	<i>Victor Veselago</i>	
17:35-18:20	Electric and magnetic dipolar response of dielectric nanospheres: Scattering anisotropy and optical forces	p. 29
<b>Invited Talk 10</b>	<i>Raquel Gomez-Medina, Braulio Garcia-Camara, Irene Suarez-Lacalle, Luis Froufe-Perez, Francisco Gonzalez, Fernando Moreno, Manuel Nieto-Vesperinas, Juan Jose Saenz</i>	
18:20-18:40	<b>Sponsor Tutorial:</b> Simulation of plasmonic nano-structures with CST MICROWAVE STUDIO® <i>Frank Demming-Janssen</i>	NA
18:40-19:00	Superlensing Effects in Anisotropic Eutectic Metamaterials in the THz Range <i>Alexey Basharin, Maria Kafesaki, Eleftherios Economou, Costas Soukoulis</i>	p. 62
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19:00-19:15	Poster Award	
19:15-22:00	<b>Workshop Dinner</b>	

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**Friday - October 28, 2011**

8:00-9:00	Breakfast	
<b>Session 9 – Chair Person: Salvatore Savasta</b>		
9:00-10:00	Probing and imaging of optical antennas with PEEM	p. 9
<b>Plenary Talk 3</b>	<i>Pascal Melchior, Martin Aeschlimann</i>	
10:00-10:45	From cavity QED with quantum gases to optomechanics	p. 39
<b>Invited Talk 11</b>	<i>Helmut Ritsch</i>	
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10:45-11:25	Coffee Break	
<b>Session 10 – Chair Person: Juan Jose Saenz</b>		
11:25-12:10	Photon Management in Thin-Film Solar Cells	p. 42
<b>Invited Talk 12</b>	<i>Carsten Rockstuhl, Stephan Fahr, Samuel Wiesendanger, Falk Lederer</i>	
12:10-12:30	Passive optical sorting of plasmon nanoparticles: Numerical investigation of optimal illumination <i>Martin Ploschner, Michael Mazilu, Tomas Cizmar, Kishan Dholakia</i>	p. 83
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12:30-14:00	Lunch	
<b>Session 11 – Chair Person: Helmut Ritsch</b>		
14:00-14:45	Polaritonic metamaterials for THz photonics	p. 26
<b>Invited Talk 13</b>	<i>Stavroula Foteinopoulou</i>	
14:45-15:05	Analysis of diffraction gratings via their resonances <i>Benjamin Vial, Mireille Commandre, Frederic Zolla, Andre Nicolet, Stephane Tisserand</i>	p. 107
15:05-15:25	Application of the Discontinuous Galerkin Time Domain Method to the Optics of Bi-Chiral Plasmonic Crystals <i>Yevgen Grynkó, Jens Förstner, Torsten Meier, André Radke, Timo Gissibl, Paul V. Braun, Harald Giessen</i>	p. 74
15:25-15:55	Coffee	

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**Session 12 – Chair Person: Carsten Rockstuhl**

15:55-16:40	Light emission and scattering in plasmonic nano-structures <i>Dmitry Chigrin</i>	p. 24
<b>Invited Talk 14</b>		
16:40-17:00	Polarization Change in Face-Centered Cubic Opal Films <i>Christian Wolff, Sergei Romanov, Jens Küchenmeister, Ulf Peschel, Kurt Busch</i>	p. 110
17:00-17:20	Nonlinear Optical Diffraction by Standing Acoustic Waves in a GaAs Film <i>Nikita Schevchenko, Natalia Dadoenkova, Igor Lyubchanskii, Florian Bentivegna, YoungPak Lee, Theo Rasing</i>	p. 89
17:20-17:30	Closing Remarks	

**Departure****11. List of posters presentations**

P1	Dual integral equations and analytical regularization technique in the study of Purcell effect for a thin dielectric disk • <i>M. Balaban, R. Sauleau, and A. I. Nosich</i>	p. 115
P2	Nonlinear transformational optics and electromagnetic and acoustic fields concentrators <i>A. D. Boardman, V. V. Grimalsky, and Yu. G. Rapoport</i>	p. 118
P3	2D electron dynamics in single layer graphene metamaterial <i>V. V. Grimalsky, I. S. Nefedov, and Yu. G. Rapoport</i>	p. 136
P4	Simulation of mutual coupling of photonic crystal cavity modes and semiconductor quantum dots <i>S. Declair, X. Song, T. Meier, and J. Förstner</i>	p. 121
P5	The effects of local fields on laser gain of composite optical materials • <i>K. Dolgaleva, R. W. Boyd, and P. W. Milonni</i>	p. 124
P6	Topology optimization of ultra-fast nano-photonic switches <i>Y. Elesin, B. S. Lazarov, J. S. Jensen, and O. Sigmund</i>	p. 127
P7	Light propagation in disordered two dimensional media and random lasing modes • <i>R. Frank</i>	p. 130
P8	FIT-TD simulation of 2nd order instantaneous non-linear materials using iterative methods <i>T. Glahn, E. Chiavaccini, and R. Schuhmann</i>	p. 133
P9	Propagation behavior of ribbed plasmonic waveguides • <i>Ch. Alain Jones, S. F. Helfert, and J. Jahns</i>	p. 139
P10	Scattering of terahertz radiation on a graphene-based nano-antenna <i>I. Llatser Martí, C. Kremers, A. Cabellos-Aparicio, J. M. Jornet, E. Alarcón, and D. N. Chigrin</i>	p. 142
P11	Monochromatic Wannier functions in the theory of 2D photonic crystals and photonic crystal fibers <i>Yu. A. Mazhirina and L. A. Melnikov</i>	p. 145
P12	Selective and optimal illumination of nano-photonic structures using optical eigenmodes <i>M. Mazilu and K. Dholakia</i>	p. 148
P13	Localization in shuffled lattice random-fill structures • <i>D. Mogilevtsev and A. Maloshtan</i>	p. 151
P14	Wavelet-based adaptive computations of the excitonic eigenstates of disordered semiconductor quantum wires <i>C. Mollet, T. Meier, and A. Kunoth</i>	p. 154
P15	Scattering of light by a discrete cross made of silver nanowires • <i>D. M. Natarov, R. Sauleau, and A. I. Nosich</i>	p. 157
P16	Non-paraxial beam to push and pull microparticles • <i>A. V. Novitsky and C.-W. Qiu</i>	p. 160
P17	<b>!!!Canceled: A silicon nano-wire factorable photon pair source • <i>W. Pernice, M. Li, and H. Tang</i></b>	<b>p. 163</b>
P18	Towards three-dimensional bidirectional eigenmode propagation algorithm • <i>J. Petracek and J. Luksch</i>	p. 166
P19	Accurate analysis of transient processes in coupled WGM microcavities with time varying refractive index <i>N. Sakhnenko and A. Nerukh</i>	p. 169
P20	Essentials of the median-line integral equation technique for the simulation of scattering by flat metal nano-strips • <i>O. V. Shapoval, R. Sauleau, and A. I. Nosich</i>	p. 172
P21	A B-spline modal method in comparison to the Fourier modal method <i>M. Walz, T. Zebrowski, J. Küchenmeister, and K. Busch</i>	p. 175
P22	Comparison between different dispersion engineering methods in slow light photonic crystal waveguides <i>F. Wang, J. S. Jensen, and O. Sigmund</i>	p. 178

## 12. Registered participants

68 participants from 20 countries

## 13. Conference records

1. AIP Conference Proceedings, ISBN: 978-0-7354-0968-2
2. Special Issue of the “Photonics and Nanostructures - Fundamentals and Applications”  
Publisher: Elsevier  
Estimated publication date: September, 2012

## 14. Best poster award

- Ksenia Dolgaleva, University of Toronto, Canada, “The effects of local fields on laser gain of composite optical materials”
- Fengwen Wang, Technical University of Denmark, Denmark, “Comparison between different dispersion engineering methods in slow light photonic crystal waveguides”